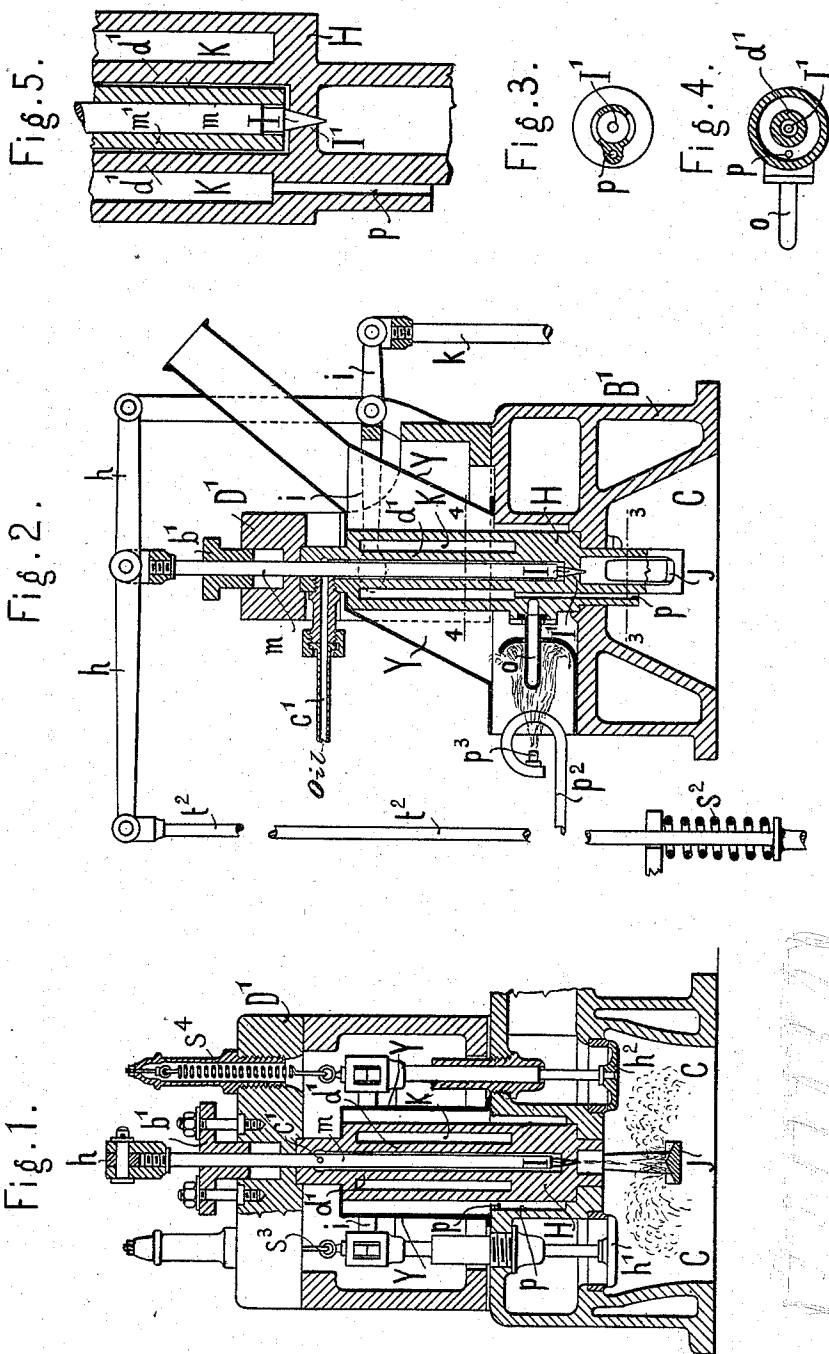


(No Model.)

V. LIST & J. KOSAKOFF.
PETROLEUM OR OIL ENGINE.

No. 535,914.

Patented Mar. 19, 1895.



Witnesses:
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UNITED STATES PATENT OFFICE.

VICTOR LIST AND JAKOW KOSAKOFF, OF MOSCOW, RUSSIA.

PETROLEUM OR OIL ENGINE.

SPECIFICATION forming part of Letters Patent No. 535,914, dated March 19, 1895.

Application filed August 2, 1893. Serial No. 482,153. (No model.) Patented in Belgium February 28, 1893, No. 103,526; in Italy March 6, 1893, LXV, 500, and in France May 23, 1893, No. 228,095.

To all whom it may concern:

Be it known that we, VICTOR LIST and JAKOW KOSAKOFF, subjects of the Emperor of Russia, residing at Moscow, in the Russian Empire, have invented new and useful Improvements in or Connected with what are Commonly Known as Petroleum or Oil Engines, (for which we have obtained patents in France, No. 228,095, bearing date May 23, 1893; 5 in Italy, No. 500, Vol. LXV, bearing date March 6, 1893, and in Belgium, No. 103,526, bearing date February 28, 1893,) of which the following is a specification.

This invention relates to engines or motors of a kind for instance, as described in our application of even date, Serial No. 482,152, which are worked by the combustion or explosion of a mixture of a hydro-carbon or mineral oil with air and the said invention consists in a novel arrangement of the vaporizer in the interior of which the liquid hydro-carbon (we will hereinafter refer to it as oil) introduced under pressure is heated being afterward injected partly in the form of vapor 20 and partly in the form of spray into the chamber in which the mixing with air and the production of the explosive mixture takes place as hereinafter described.

The improved vaporizer according to this invention forms a chamber directly connected with the explosion chamber of the engine the liquid hydro-carbon being forced into an extended but narrow space or passage or spaces or passages which may be formed by the surfaces of bodies which become heated, the said bodies being placed in close proximity one within the other, the space or spaces being separated by a valve from the explosion chamber. The said heated bodies may consist of a heated tube, for example, and a well fitted rod or bar inserted therein so arranged that the oil can be forced into the space between them or they may consist of tubes one being inserted within the other so that there 45 is a narrow space between their adjacent surfaces. The oil being forced into this narrow space is so strongly heated by the hot walls or sides of the tubes, or the like, that the light volatile parts—the low hydro-carbons—of the oil become converted into vapor in the said narrow space while another part of the oil—of

less volatility—, owing to the high pressure to which it is subjected, becomes partially superheated and remains liquid until the valve is opened when it flows through the latter and 55 becomes instantaneously converted into vapor owing to the reduction in pressure which it then experiences. The remainder—hydrocarbons of least volatility—passes through the valve and is blown by the action of the vapor 60 into extremely minute particles which are consumed when the combustion or explosion of the mixture takes place.

The forcing of the oil to be evaporated through the narrow space or passage and the opening of the valve closing the narrow passage take place simultaneously with the compression in the explosion chamber of the engine so that an intimate mixture of the previously admitted air with the gases and vapors is insured. In order to obtain a more certain and intimate mixture of the unvaporized fine spray of oil with the air, the vapor and the finely pulverized oil are caused to impinge against a device presenting multiple inclined surface whereby the vapor and liquid particles are caused to have a whirling motion and are thereby brought into very perfect and intimate contact with the air. The walls of the aforesaid narrow passage or passages are heated by means of the gases escaping from the lamp employed to heat the igniting tube of the engine provided with the improved vaporizer and when the engine is in motion the heat of the products of the explosion is also utilized for the same purpose being conducted into a space or chamber surrounding the vaporizer through a passage which also connects the igniting tube with the charging space of the engine at a place where 90 an explosive mixture is certain to be present after the compression of the charge.

In order that our said invention may be fully understood we shall now proceed more particularly to describe the same and for that purpose shall refer to the several figures on the annexed sheet of drawings the same letters of reference indicating corresponding parts in all the figures.

Figure 1 of the accompanying drawings 100 represents in vertical section an example of a vaporizer constructed according to this in-

vention. Fig. 2 illustrates the vaporizer likewise in vertical section, the section being taken at right angles to the section in Fig. 1. Fig. 3 illustrates part of the apparatus in horizontal section, the section being taken on the line 3—3 Fig. 2 and viewed from below. Fig. 4 represents another part of the apparatus in horizontal section the section being taken on the line 4—4 Fig. 2. Fig. 5 illustrates in section a modified form of an important part of the vaporizer.

In the example of a vaporizer constructed according to this invention as represented in Figs. 1 to 4 the vaporizer proper (hereinafter described) is combined with an igniter *o*, a mineral oil or naphtha vapor lamp *p*² *p*³, a heating chamber *Y*, a charging or explosion chamber *C* and two mechanically controlled air valves *h*¹ and *h*². The vaporizer is constructed with a body *H* represented as being of cylindrical form with hollow sides and as being arranged between the cylinder cover *B*¹ of a petroleum or oil engine (the other parts of which are not shown in the drawings as they may be of any ordinary or suitable construction), and a transverse bridge piece *D*¹ connected to the said cover. The body *H* is effectually insulated from the bridge piece *D*¹ and the cylinder cover *B*¹ by means of asbestos or other suitable packing and is formed with a tube *d*¹ surrounded by an annular chamber *K* communicating through a passage *p* (Fig. 2) with the combustion or explosion chamber *C*. In the longitudinal axis of this vaporizer and capable of sliding in the direction thereof is arranged a rod *m* provided at its lower extremity with a valve *I* fitted accurately to a seat or valve opening *I*¹ onto which it is pressed by a spring *s*² acting through a rod *t*² and a lever *h* upon the valve rod *m*. The upper part of this rod works in a tight fitting stuffing box *b*¹.

By means of a tube *c*¹, Fig. 2, liquid oil is pumped into the space between the sides of the tube *d*¹ and the rod *m* under high pressure. The said oil present in the narrow concentric space between the rod *m* and the externally heated side or sides *d*¹ becomes so highly heated that the more volatile part thereof is converted into vapor in the said space while a less volatile component part of the oil, owing to the pressure is partly superheated and is not converted into vapor until the pressure is reduced on its escaping through the valve opening *I*¹ whereupon it is immediately vaporized while a part still less readily convertible into vapor escapes in liquid condition through the valve opening *I*¹ where it is atomized by the rush of vapor and consumed in the next explosion.

In place of causing the oil to pass through the tube *d*¹ in direct contact with the rod *m* the said rod may be inserted in a tube or sheath *m*¹ as represented in Fig. 5, the oil being caused to flow in the space between this sheath and the tube *d*¹. By these means we

are enabled in a simple manner, that is without altering the height of the whole vaporizer, to increase the capacity of the same, merely by increasing the sectional area of the narrow space or passage through which the oil is to be forced and at the same time to facilitate repairs, when the circumference of the rod *m* should be worn, in which case the sheath *m*¹ is replaced by a new one.

The forcing of the oil to be evaporated through the narrow space or passage and the opening of the valve *I* are arranged to occur at the same time the compression takes place in the explosion chamber *C*. This chamber during the compression period contains pure air which entered through the valves *h*¹ and *h*², this air having been mixed with the products of the preceding explosion. In order to insure a thorough and intimate mixture of the oil vapor and the unevaporated atomized oil, with the air in the combustion chamber *C* a plate *J* having inclined sides or surfaces (Fig. 1) is provided opposite to the valve opening *I*¹ against which plate the jet of vapor and oil is caused to impinge and is deflected by the said inclined surfaces so as to have imparted to it a whirling movement, thereby forming an intimate mixture of the air and products of combustion. As the compression of the mixture in the chamber *C* (which is directly connected with the cylinder of the engine) proceeds, the line of demarcation between the residual products and the fresh charge gradually moves back through the small passage *p* (Fig. 2) toward the hollow space *K*, so that just when the piston reaches the end of its back stroke the fresh mixture enters the ignition tube and is exploded by contact with the heated walls thereof, the explosion extending throughout the chamber *K* and through passage *p* proceeds to the chamber *C* whence the force developed is transmitted by the piston to the motor.

The mineral oil or naphtha vapor lamp for the igniter consists of a bent tube *p*², Fig. 2, provided with a nipple or nozzle *p*³. The mineral oil or naphtha supplied under pressure through the tube *p*² is vaporized in the curved or bent part of the said tube (which is heated by the flame of the lamp) and escapes from the nozzle in the form of vapor which mixes with air in the vicinity of the ignition tube *o* where it burns and heats the igniter, while the products of its combustion pass through the flue or heating chamber *Y* and heat the vaporizer.

In starting an engine provided with this improved vaporizer the vaporizer is heated by the lamp but when the engine is at work it is further heated by the products of combustion in the surrounding space *K*. Moreover in case the governor owing to an excessive speed of the engine, causes an explosion or explosions to be omitted, the vaporizer is heated by the lamp alone, so that the vaporizer is maintained at an approximately uniform tem-

perature, independently of whether the machine is working under a load or otherwise.

We claim as our invention—

1. In a vaporizer for petroleum or oil engines, the combination of a movable rod *m*, with a highly heated wall *d'*, both being placed in close proximity one within the other so as to form an extremely narrow space or passage between both, extending along the said tube and communicating on one end by tube *c'* with the pressure side of an oil pump or with a reservoir containing oil under pressure, the narrow space or passage on the other end in its communication with the combustion chamber below being controlled by a valve *I*, substantially as and for the purpose specified.

2. In a vaporizer for petroleum or oil engines; the wall *d'* and rod *m* constituting the narrow space, as described, in combination with a deflecting plate *J* opposite to the outlet from the valve *I*, and arranged in the com-

bustion chamber, to break up or spray unvaporized parts of the oil and mix them thoroughly with the volatilized parts of the oil and with air, substantially as set forth.

3. In a vaporizer for petroleum or oil engines, a movable rod *m*, a wall *d'*, placed in close proximity one with the other, to form an extremely narrow space of annular form, combined with a surrounding space *K*, and a passage *p* leading from space *K*, both to the combustion chamber *C* and igniter tube *o*, substantially as hereinbefore described.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

VICTOR LIST.
JAKOW KOSAKOFF.

Witnesses:

IVAN RATTENEER,
FR. SCHILHAN.